Background

Microorganisms and their byproducts are considered to be the major cause of pulp and periradicular pathosis leading to endodontic failure, hence the main objective of endodontics is to eliminate microorganisms and provide a hermetic seal coronally and apically. This *in vitro* study was done to evaluate the antimicrobial effect of Calcium Hydroxide ($Ca(OH)_2$), 2% Chlorhexidine (CHX), Triple Antibiotic Paste (TAP) and Chitosan nanoparticles (CSnps) against *Enterococcus faecalis* (*E.faecalis*), *Streptococcus mutans*(*S.mutans*) and *Candida albicans*(*C.albicans*).

Materials and Methods

Root canals of 180 freshly extracted single rooted permanent mandibular premolar human teeth with straight canals were standardized to a uniform length of 16mm after decoronation. All the root canals were instrumented with the sequence of Universal Protaper rotary system according to the manufacturer's instructions. The coronal two-thirds of the canals were prepared with the shaping files SX. Subsequently rotary instrumentation was accomplished to working length using S1, S2, F1, F2 and finally F3. The samples were sterilized in an autoclave at 120^{o}C for 15 minutes. Then the samples were broadly divided into three main groups with a sample size of 60 teeth (n=60). Each group of samples were contaminated with their respective organisms namely *E. faecalis, S.mutans* and *C.albicans* and incubated for 21 days. The samples were further subdivided into four experimental subgroups and one control group (n=12). The teeth in each subgroup were treated with one of the experimental medicaments namely $Ca(OH)_2$, CHX, TAP and CSnps. Microbial samples were obtained from the root canals after 7 days and optical density of the

culture was obtained after 24 hrs of incubation using spectrophotometer. The Culture density was calculated from the obtained optical density values.

Statistical Analysis

Data were analyzed statistically using Statistical Package for Social Sciences, (SPSS) version – 10 Software for Windows. Data were expressed in its mean and standard deviation and were analyzed using one way ANOVA and Student "t" test.

Results

There was a significant reduction in the microbial count for all the medicaments tested when compared with the culture group (p Value < 0.05). CSnps (*E.faecalis* 9.4043%, *S.mutans* 9.8635%, *C.albicans* 52.4408%) displayed the highest antibacterial efficacy and $Ca(OH)_2$ (*E.faecalis* 74.9883%, *S.mutans* 76.395%, *C.albicans* 83.2334%), the least. CHX (*E.faecalis* 20.7217%, *S.mutans* 37.3200%) showed similar antibacterial activity to CSnps (*E.faecalis* 9.4043%, *S.mutans* 9.8635%) but antifungal activity of CHX (*C.albicans* 77.1233%) was similar to $Ca(OH)_2$ (*C.albicans*-83.2334%) and TAP (*C.albicans* 80.1833%). Antimicrobial activity of TAP (*E.faecalis* 57.8725%, *S.mutans* 65.9350%, *C.albicans* 80.1833%) was similar to $Ca(OH)_2$ (*E.faecalis* 74.9883%, *S.mutans* 76.395%, *C.albicans*-83.2334%).

Conclusion

Within the limitations of the present study, it can be concluded that

1. All the four medicaments used in this study exhibited significant reduction in bacterial count in experimentally infected root canals.
2. Chitosan nanoparticles (CSnps) had the highest antimicrobial effect against *E.faecalis*, *S.mutans* and *C.albicans*, compared to 2% Chlorhexidine (CHX), Triple Antibiotic Paste (TAP) and Calcium Hydroxide $Ca(OH)_2$. Hence it can be considered as an alternative intracanal medicament to commercially available $Ca(OH)_2$.
3. CHX showed a promising antibacterial activity, but its antifungal activity was similar to TAP and $Ca(OH)_2$.
4. Antimicrobial activity of TAP was superior to $Ca(OH)_2$ with no statistical significant difference but inferior to CHX and CSnps.
5. $Ca(OH)_2$ was least effective against all the three microorganisms when compared to all the tested organisms, hence its use as intracanal medicament should be minimized and use of other medicaments should be encouraged.

Keywords:

Streptococcus mutans, *Candida albicans*, Spectrophotometry, Calcium Hydroxide, Chlorhexidine, disinfection, *Enterococcus faecalis*, Antibiotics.